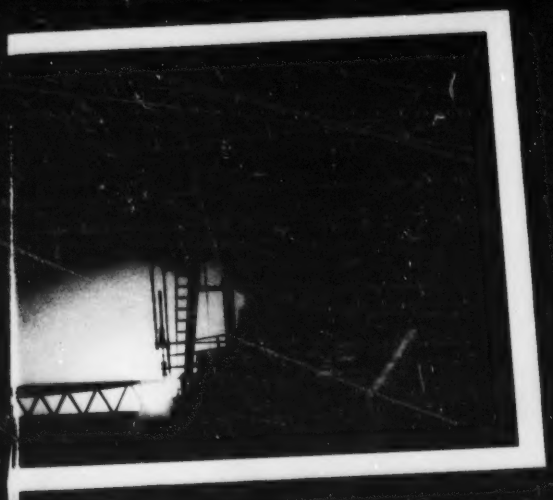

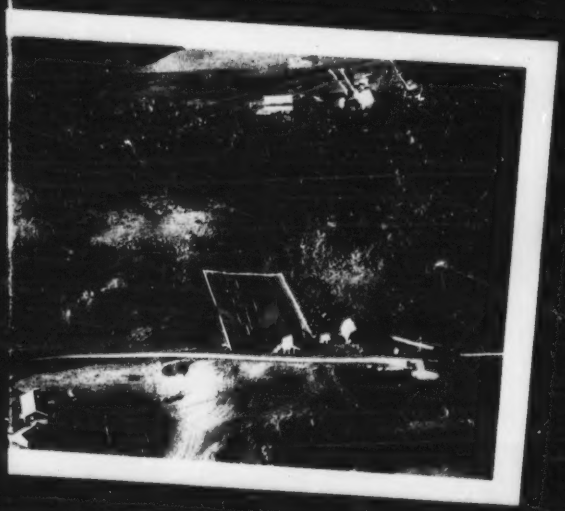

Getting to Know
Your Local Watershed

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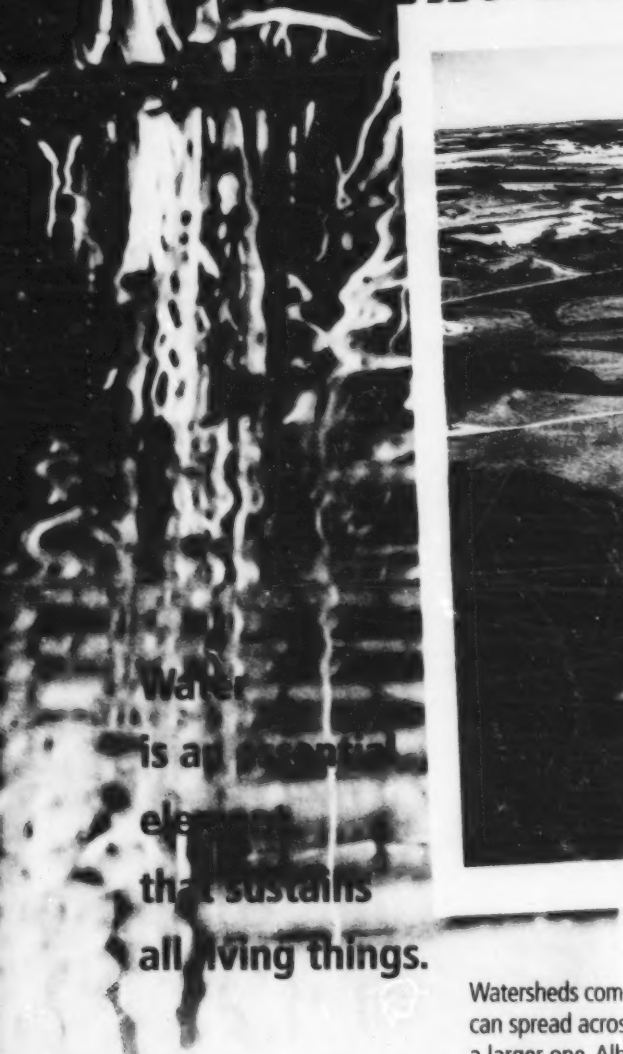
Understanding Watershed Management

Water surrounds us.

Whether it is in the form of a farm dugout, lake, river or the groundwater beneath our feet, water is one of the earth's most precious resources.



Lorne Fitch

Water is an essential element that sustains all living things.

Watersheds come in all shapes and sizes. From big cities to small farming communities, watersheds can spread across thousands of miles or only a few. There can be many smaller watersheds within a larger one. Alberta has eight major watershed areas that cross into other provinces and the United States. Regardless of size, it's what we do within our individual watershed that affects the overall quality and quantity of the water we all use and depend upon.

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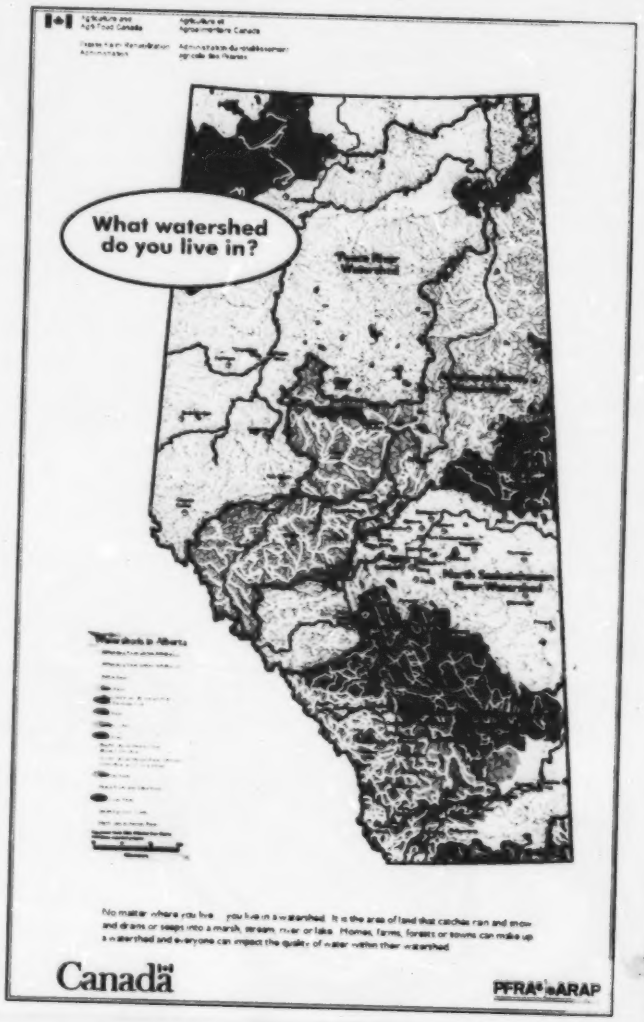

Watershed - a simple definition:

It's the area of land that catches rain and snow, and drains or seeps into a marsh, stream, river or groundwater.

Why is it important to live within a healthy watershed?

The benefits are numerous. A healthy watershed regulates the flow of water. Many industries rely on access to clean, abundant water sources. For the agriculture industry, a properly functioning watershed helps maintain high forage production, ensures better crop resistance to drought and results in better livestock health and weight gains. In terms of ecological benefits, watersheds provide diverse wildlife habitat and regulate processes such as soil erosion and sedimentation. Clean water offers a higher quality of fresh drinking water, as well as recreational opportunities.

Understanding Watershed Management is a guide for those who want to organize a local partnership to protect their watershed, develop a watershed management plan and implement and evaluate that plan. The overall goal in watershed management is to establish a sustainable plan that works toward building an environmentally and economically healthy watershed – one that benefits all those who have a stake in it.

Understanding Watershed Resources, the first section of this manual, looks at understanding how a watershed functions, its resources and the natural processes that exist within a watershed. The second-half of this manual, **Understanding Watershed Management**, provides information on what you can do when forming partnerships with different people and organizations to address common interests and concerns for the watershed. Cooperation encourages more acceptable ways for protecting natural resources, while minimizing the chance of negative social and economic impacts. More information on how to set up a watershed group is listed in the publication Building Community Partnerships, A Guide for Creating Effective Land and Water Stewardship, available from Alberta Agriculture, Food and Rural Development or Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration.

The successes and challenges of the **Crowfoot Creek Watershed Group** are profiled in this manual. This group identified Alberta's increasing pressure to remain globally competitive, while at the same time, providing responsible stewardship of natural resources. As its group leader, Leigh Christensen says, "We need to get the agriculture industry engaged – everything we do affects water quality". It's interesting to see how one group, in particular, improved its watershed, even though they may not provide the framework for every watershed group. Each watershed is different, so it's necessary to establish a plan that works for the stakeholders involved.

As the demand for clean water increases, the quality and quantity of Alberta's water supply will continue to be a prominent issue in the future. A watershed is similar to a puzzle with many pieces; each piece affects the function of the entire watershed. Even though our individual actions may seem small, collectively they greatly affect the bigger, environmental picture. How we manage our part is critical to keeping a watershed healthy.

Hydrology:

The Science of Water Movement

Although there is only a limited amount of water available on earth, it's constantly being recycled. Water, as a liquid, evaporates into the atmosphere from the sun's heat. Precipitation then brings it back down to the earth's surface. This cycle continually moves water in and out of the earth's watersheds.

One of the primary functions of a watershed is to regulate the water in the hydrological cycle by collecting, storing and then slowly releasing water from the soil. The amount or level of water in various parts of the watershed is dependent upon soil conditions, vegetative cover, the length and slope of the drainage landscape, climate of the area and the time of year.

When understanding how a watershed works, it's important to know how the water cycle operates:

1. Water returns to oceans and lakes through groundwater, surface runoff or rivers.
2. Water evaporates from the sun's heat energy. The water can be from the surface of lakes, dugouts, rivers, and oceans, as well as from the land. Transpiration is moisture evaporating from plants into the atmosphere.
3. Rainwater may flow over the land's surface into streams and lakes or be used immediately by plants and animals.
4. Infiltration is the downward movement of water through cracks, joints and pores in soil and rock. Infiltrating water can move into the groundwater. Water seeping into the soil is used by many life forms.
5. Precipitation, including rain, snow and hail, develops from clouds. Clouds form from condensed water vapour. When clouds cool, the air becomes saturated with water and the water begins to fall as rain, snow or hail.
6. The topography of the land, such as mountains, valleys and large hills, force clouds upward into cooler parts of the atmosphere. This creates regions with moist conditions, such as along North America's Pacific coastline. Conditions on the eastern side of the mountains are often very dry in the rain shadow.

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Part One

Understanding Watershed Resources

Watersheds have three primary purposes: to capture water, store it in the soil and release it. Yet each watershed is a unique biological and physical process, making it difficult to draw generalized management recommendations for protecting a watershed.

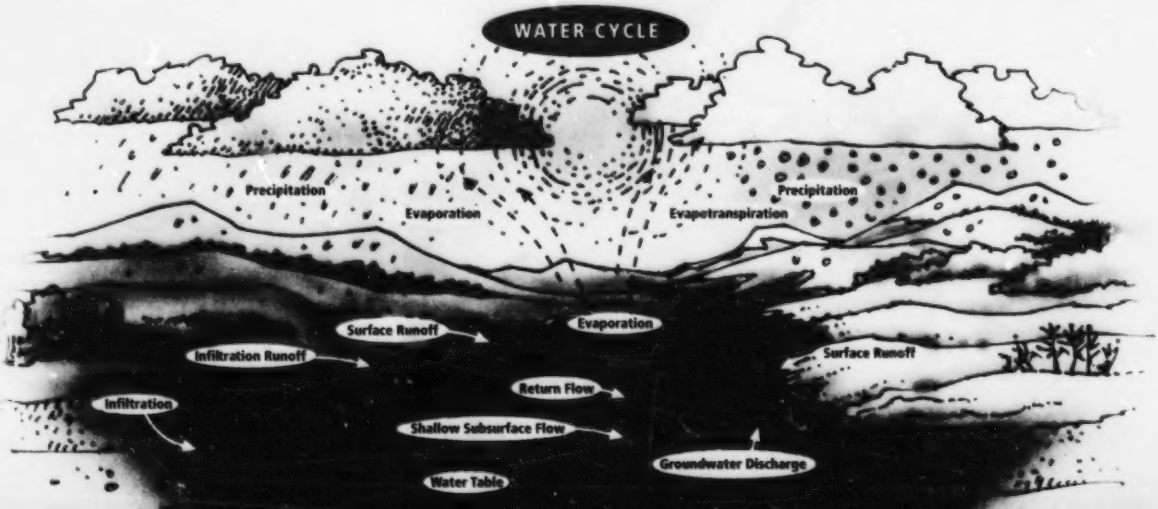
Watersheds are continually changing and evolving. Some changes are natural, or are accelerated by human activities. Importantly, a watershed contains information about all the things happening within it: climate, soil moisture, soil texture, organic matter and chemistry, topography and drainage paths.

Watersheds also tell us about land use history, natural and man-made disturbances. There are many examples of how we can possibly affect a nearby watershed. One such example is over fertilizing a lawn, which results in the polluting of our surface and groundwater.

Once such information has been collected, work can begin on designing a plan that will help improve the watershed. Both public and private agencies offer help in detecting if change is occurring within the watershed. Technical consultants and specialists can assist in designing watershed monitoring programs. More information about contacting these professionals is located in the References and Other Information Sources section of this manual.

AAFRD

When understanding how a watershed works, it's important to look at the water cycle, and how it affects you.



Parts of a Watershed

Each part of a watershed is unique, even though the characteristics of any watershed are similar. All watersheds flow from headwaters to outlets, eventually ending in an ocean. As the water flows, it passes through many parts. And like the parts of a puzzle, if one happens to be damaged, the result affects the whole picture.

This section identifies the parts of a typical watershed.

Climate

Climate is described as the average and extremes of the weather experienced in a region. There are four main factors that determine the climate of an area: position on the globe, wind systems, the ratio of water to land and topography. However, latitude has the biggest effect on climate. Both the intensity of the sun's radiation and wind circulation patterns change with latitude.

In the watershed area, the climate of a region will affect the amount of runoff, surface water, the level of the water table and the vegetative species growing in the area.

Topography

Topography defines the entire watershed, as it shapes the course and speed of water moving through the area. Topography can help evaluate runoff risk. Flat ground, that is less than two percent slope, has the least chance of runoff. Ground that has slight (two to 10%) to moderate slopes (10 to 15%), have a greater chance of runoff. And steep areas that have a slope greater than 15% have the greatest chance of runoff.

The following factors can assist in determining the runoff potential of a section of watershed:

- Precipitation (high or low);
- Soil drainage/type (sand or clay);
- Surface water entering the area;
- Vegetative cover (good or poor);
- Flood hazard (high or low); and,
- Tall trees on the perimeter of a site may shade and modify snowmelt and runoff.

Topography also influences climate. This is significant for Alberta, as the Rocky Mountains force the air masses to rise and drop their moisture as precipitation, creating wet conditions on their western slope, and drier conditions on their eastern slope. On a smaller scale, valleys have very different climates from surrounding level areas.

Topography can play a role in creating showers. Air moves upward as it passes over rising ground. This action increases cooling and thus more precipitation. A combination of moist air, a southeasterly wind and rising topography result in upslope precipitation. In Alberta, for example, the Milk River Ridge, the Hand Hills and the Clear Hills have higher precipitation than surrounding areas.

In Alberta, **surface water quality** is evaluated according to the purposes it serves. Surface water does not include drinking water, as all drinking water must be treated before we consume it. Alberta surface water quality guidelines have been established to protect:

- Aquatic life
- Agricultural uses (stock watering and irrigation)
- Recreational and aesthetic purposes
- Industrial and municipal raw water supply

Surface Runoff

Runoff is a complex function of many environmental elements including precipitation, infiltration and vegetation. Faster flowing runoff will also occur if the slope of an area is steep. Short, intense storms deliver more runoff, because there is less time for the water to filter into the ground. It's during these storms that surface runoff can directly transport nonpoint source pollutants from the land to surface waters.

Sediment is probably the most common and easily recognized nonpoint source pollutants. Contaminants attached to sediments can move with surface water runoff into water bodies or can be transported by the wind.

Pollution:

Any entry of manure nutrients, solids and or microorganisms into surface water, groundwater or soil that diminishes their usefulness.

LORNE FITCH

Infiltration

Water infiltration depends on soil attributes such as texture, structure and the depth of soil layers. These parameters determine the soil's water-holding characteristics and tendency to erode. Here are some examples:

- In gravel, water flows more easily through the soil and results in less runoff. In contrast, clay soils contribute to a higher runoff because the water needs more time to filter in.
- An impervious surface, such as an asphalt driveway or a compacted surface, doesn't allow runoff to infiltrate the soil. This results in a higher amount of runoff.
- Soils in vegetated areas help to slow runoff, allowing greater infiltration. This reduces the amount of water reaching other water bodies.

Flowing Waters

Streams and rivers are continually on the move as part of the watershed. Flowing waters are rich in oxygen. This is an essential element for fish and many other aquatic animals. More oxygen is found in cold water than warm water. The shade from the trees and willows along stream banks (riparian areas) help keep waters cool, and improves aquatic life.

Still Waters

Ponds and lakes are an integral part of a watershed. The basic difference between a pond and a lake is not its size, but its depth. Both will support various types of plant life, depending on environmental factors such as soil nutrients. This plant life varies from emergent and floating vegetation along shorelines, to floating and submergent vegetation in deeper water.

Over time lakes slowly fill in with soil and organic matter. This natural aging process is called succession. This process is important to be aware of when evaluating the health of a lake system. Even though we may not see changes in a lake for many years, human activity can dramatically speed up succession.

Dams

Dams change the physical properties of a water body, turning it from a river ecosystem into a large lake ecosystem. This affects those species that live in flowing waters and oxygen-rich conditions. The water behind dams has less oxygen because there is less movement and because decomposition uses up oxygen. Dams also disturb traditional fish migration routes and trap nutrients and sediment.

Eutrophication:

Eutrophication is the process of nutrient enrichment in an aquatic habitat, which can lead to oxygen depletion when the vegetation/algae decomposes. Although eutrophication is natural, human activities in the surrounding aquatic environment can speed up the process.

SOME COMMON TYPES OF WETLAND AREAS:			
Common Name	**Characteristic Vegetation**	**Water Supply**	**Soil Type**
Marsh	cattails, sedges, rushes	very efficient at supplying water and nutrients to vegetation near surface	mineral high organic content
Bog	sphagnum moss	water from runoff and precipitation only	thick layer of highly acidic peat extends beneath bog
Swamp	shrubs and trees e.g. soft maple/cedar	occasional flooding	organically rich mineral soils
Fen	grasses, sedges	some flow-through	neutral & alkaline

(Source: OMAFRA Water Management BMP 1994)

Wetlands

Wetlands play a large role in a watershed by protecting water quality and moderating water quantity. Essentially, wetlands function as nature's kidneys to keep the water clean.

There are many kinds of wetlands, some of which may not always be covered by water. However there is usually enough water in a wetland to both promote and support the growth of aquatic plants and animals for at least a portion of the year. Importantly, wetland areas help regulate the amount of surface flow. They collect water during wet periods, such as spring snowmelt, and store it, and release it, making it available to plants and animals during dry periods.

Wetlands also help reduce flooding intensity and improve groundwater recharge. The infiltration from wetlands serves to maintain water levels in aquifers replenishing water in wells used by both humans and livestock.

Groundwater

Groundwater is a valuable water resource flowing beneath our feet, filling the openings and pore spaces in soil and rock layers.

Groundwater recharge is done through the infiltration of surface water that seeps into the ground. Beneath the groundwater lies the water table, where the soil is completely saturated with water. Groundwater quality is greatly influenced by natural conditions and human activities. Prominent issues surrounding groundwater are its quality and quantity. Consider these facts:

- Scientists estimate groundwater accounts for more than 95% of all fresh water available for human use;
- Nearly 95% of rural residents rely on groundwater for their drinking supply; and,
- Groundwater fulfills approximately 1/3 of industrial water needs.

(Source: Groundwater & Surface Water: Understanding the Interaction. www.ctic.purdue.edu/KYW)

Let's look a little closer at how groundwater functions beneath our feet.

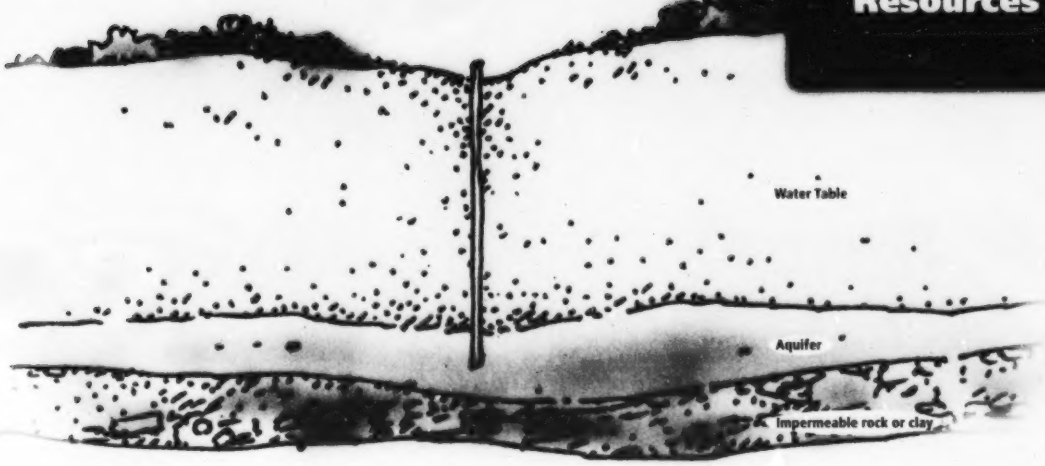
Movement and Recharge

Groundwater moves slowly and continually due to differences in underground pressure. Sewage, manure, chemicals and other contaminants can enter the ground at higher elevations and make their way into aquifers through shallow water tables. Not all recharge areas are visible to the untrained eye. Learning where watershed recharge areas are will help you determine potential groundwater areas in the watershed.

Wetlands:

A low-lying area of land that tends to be covered by water frequently enough to support aquatic plants and wildlife, at least in some years. All wetlands include a surrounding riparian area which is easily recognized as the transitional zone of wetland-related vegetation, that is distinctly different from dryland vegetation.

Understanding Watershed Resources



Groundwater is an extremely important, albeit, hidden, supply of water. Aquifers store water and gradually release it to rivers and to surface soils, where it is used by vegetation and animals. People living in rural areas and in some inland cities rely heavily on groundwater. Wells are dug or drilled into the ground in order to reach the aquifer, and water is then pumped to the surface.

Seepage

Groundwater is recharged by infiltration from both moving and standing bodies of water. This includes lakes, rivers, creeks, marshes, dugouts or sloughs. Natural recharge is often affected by our activities on land. For example, draining a slough, which increases the water movement off the surface, reduces the amount of water that filters into the ground to become groundwater. Reduced groundwater recharge then decreases the water levels in nearby shallow wells.

Seepage provides a conduit for groundwater contamination. Abandoned wells and seismic holes, if improperly sealed, allow contaminated surface water to bypass the overlying protective soil profile. Be sure these areas are properly sealed.

This section briefly reviews how certain land characteristics interact with water.

Characterizing what's going on within a watershed provides critical information about its health. Knowing more about certain land resources, such as the soil, can help us to identify ways to prevent or minimize damage to water quality, fish or wildlife habitats.

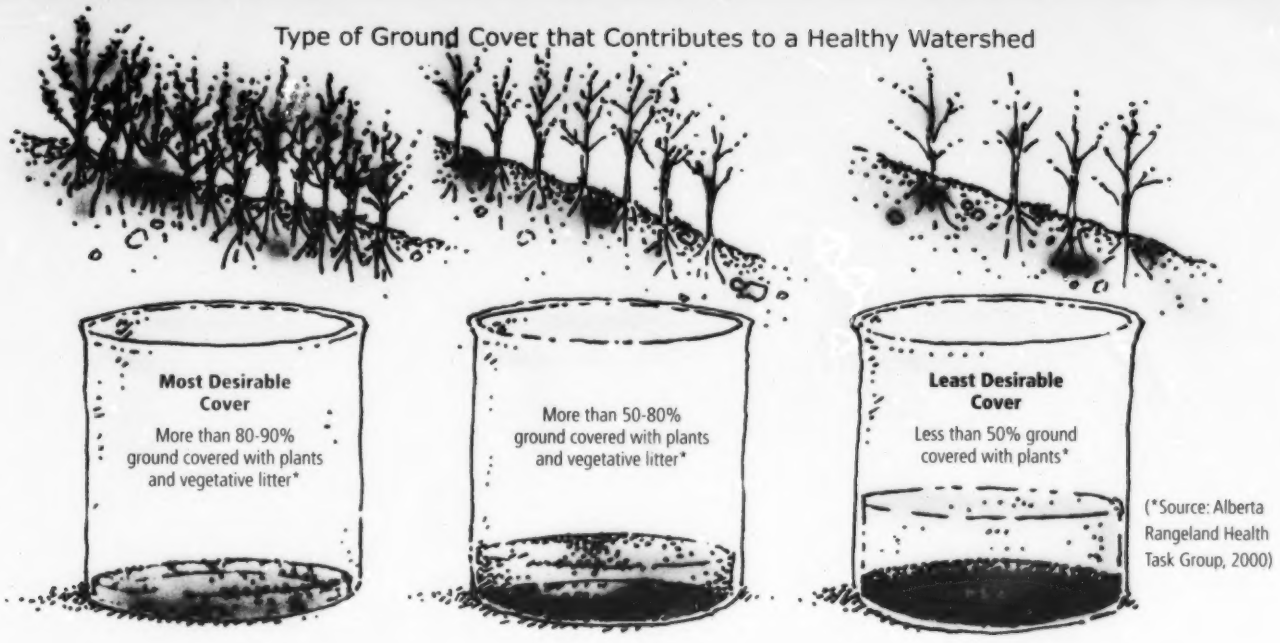
Soils

Soil management plays an important role in how much water is held in the watershed. Identifying soil types is the first step to maintaining and improving soil. Several natural characteristics affect the amount of water in soils, such as: soil type and structure, slope, depth to water table and climate.

Typically, water moves slowly through fine-textured soils such as clay. Clay soils and soils higher in organic matter tend to absorb more nutrients from the water than sandy, gravelly soils. Some soils are easily eroded, allowing sediment to contaminate the water source.

SOIL TYPE	RATE OF WATER MOVEMENT INTO SOIL		MM OF WATER AVAILABLE IN A METRE OF SOIL	
	Bare soil	Cropped soil	Saturated soil	Available to plants
Sand	fast	fast	100 (4")	75 (3")
Silt loam	medium	fast	267 (10.68")	167 (6.68")
Loam	medium	fast	283 (11.32")	167 (6.68")
Clay loam	medium	medium	317 (12.68")	167(6.68")
Clay	slow	slow	325 (13")	117 (4.68")

(Source: OMAFRA Water Management BMP 1994)


Type of Ground Cover that Contributes to a Healthy Watershed
Most Desirable Cover
More than 80-90% ground covered with plants and vegetative litter*
More than 50-80% ground covered with plants and vegetative litter*
Least Desirable Cover
Less than 50% ground covered with plants*
(*Source: Alberta Rangeland Health Task Group, 2000)

Typically, water moves slowly through fine-textured soils such as clay. Clay soils and soils higher in organic matter tend to absorb more nutrients from the water than sandy, gravelly soils. Some soils are easily eroded, allowing sediment to contaminate the water source.

Crop residue allows for greater infiltration and higher soil moisture due to increased soil organic matter. An increase in organic matter is beneficial for holding nutrients for future crops-organic matter has a large surface area that allows nutrients to adhere to the soil surface.

Information on soil types also indicates the risk of both surface and groundwater contamination. Soils identify those areas that are more suitable for certain types of production and those that may be more susceptible to impacts from erosion or seepage.

Vegetation functions as ground cover to maintain soil stability, prevent soil erosion and to provide nutrient and energy cycling. Vegetation captures and slowly releases water to benefit the entire watershed.

Vegetation plays an important role in binding soil together. It also intercepts rainfall, and thus reduces sediment in the surface runoff, slows runoff and enhances infiltration.

Topographic factors such as slope and surface depressions determine flow velocity and surface storage.

Riparian Areas

Riparian areas are the lands adjacent to water bodies where the vegetation and soils are strongly influenced by the presence of water. If the riparian area is healthy, vegetation in these areas would include trees, shrubs, as well as the dense growths of deeply rooted grasses, forbs and sedges. A riparian area plays a complex role in slowing and filtering runoff water. For example, healthy riparian areas can slow the water and filter up to 50% of phosphorus, 90% of sediment and 80% of nitrate runoff before it reaches open water.

(Source: Caring for Alberta's Rural Landscape: Tips and References for Owners of Small Farms and Acreages publication)

Healthy riparian areas decrease the erosive force of water in a flood by slowing water velocity. This slow down allows sediment to be deposited in the vegetated area, providing new soil for plants to use.

Buffer Zones

A buffer zone is a healthy well-vegetated area alongside a riparian area. The vegetation of the buffer also functions as a filter. Buffer zones can include pasture with sufficient litter and stubble residue, grassed waterways, and trees and shrubs. Buffer zones, if healthy, can help to maintain water quality. They have the capacity to:

- Remove up to 50% or more of nutrients and pesticides;
- Remove up to 60% or more of certain pathogens; and,
- Remove up to 75% or more of sediment.

(Source: Buffer Strips: Common Sense Conservation. www.nhq.usda.gov/CCS/Buffers.html)

The above results occur through a combination of settling, filtration, dilution, absorption, infiltration and plant uptake of nutrients.

PFRA

PFRA

It's important to maintain a healthy well-vegetated riparian area and a buffer zone between upland areas and water bodies. A buffer strip of trees or vegetation is an effective tool in removing surface and subsurface contaminants of water, such as nitrate and phosphorus. The 'stream-side' forest functions as a filter by sucking up huge volumes of potentially contaminated water.

Biodiversity

Biodiversity is measured as the number of different living creatures residing in an area of land or water. Maintaining or improving the diversity of a landscape is an important part of maintaining a healthy watershed. How we manage riparian areas, maintain land cover and control runoff all contribute to biodiversity.

This list illustrates the biodiversity found on Alberta's landscapes. Alberta's landscapes support approximately:

- **90** species of mammals;
- **250** species of resident breeding birds;
- **50** species of fish;
- **8** species of reptiles;
- **10** species of amphibians;
- **1918** species of vascular plants;
- **475** types of mosses;
- **147** types of liverworts/hornworts;
- **767** types of lichen; and,
- **454** species of fungi.

Here's an example about having wildlife on your land and how one animal often affects another...

A Management Solution brought to you by Mother Nature

Grassland birds burn the candle at both ends during the time they spend with us in Canada. They sing from before dawn until the last light is gone. They protect their territories and forage to feed themselves and often several broods of chicks. Because of all this activity they eat a lot of insects. Their rapidly growing chicks eat even more. Studies show grassland birds feed each chick with a grasshopper, beetle or spider, 6–12 times for 18–20 hours a day. That works out to 108–240 bugs per day for each chick!

(Source: Nestling Diets of Prairie Passerine Birds at Matador, Saskatchewan, Canada)

There are also hundreds of primitive plant species, tens of thousands of insect species and an unknown number of microbe and other invertebrate species.

Wetlands, forests and native grasslands are good examples of natural habitats. They play a key role in oxygen production and removal of atmospheric carbon dioxide to help purify and store water. Contributing to the biodiversity on our land, as a result, contributes to the health of the watershed.

Groundwater, surface water, air quality, wildlife and human activities all affect each other.

These pieces are part of the larger environmental picture. Gathering information about them gives us a clearer picture of what is happening within the watershed. Once the information has been gathered, the next step is to analyze how it can be used to improve the watershed and begin forming alliances with those people living and working within the watershed.

Crowfoot Creek Watershed Group: A Study in Community and Commitment

PHIL BOEHME

A strong sense of community and commitment are just two key elements in the success of the Crowfoot Creek Watershed Group (CCWG).

Crowfoot Creek is a tributary of the Bow River located 85 km east of Calgary in Wheatland County. The area has a high rate of population growth, a high degree of agricultural intensity, an expanding oil and gas industry and is seeing an increase in irrigation use.

The watershed planning process in that area began when the Wheatland County Agricultural Service Board (ASB) undertook a water needs assessment which led to a municipal resource planning project and a study of historical water quality data in 1995, says Phil Boehme, CCWG's watershed coordinator.

"The ASB partnered with Prairie Farm Rehabilitation Administration (PFRA) to contract a water quality specialist to analyze the data," he says. The results of that study indicated increasing fecal coliform bacterial levels and nutrients that often exceeded water quality guidelines. "This information was then brought back to the community," says Boehme.

In 1996, an agricultural impacts study was then spearheaded by Alberta Agriculture's Irrigation Branch, Wheatland County ASB and other partners, with support from the community. Once the community was aware of the water quality issues, they formed the CCWG to proactively address these issues, says CCWG chairman Leigh Christensen, a direct-seeding farmer from Standard, Alberta.

"It was uncharted terrain-no one had done this before," says Christensen as he speaks of how the watershed group formed. "The thing is, everyone is downstream from someone," he explains. "We needed to start in our own backyard in terms of fixing the (water) problems."

The group officially formed in 1999, and now has 65 volunteer members. Since then, CCWG has examined watershed awareness levels by conducting personalized surveys with local landowners. Demonstration sites featuring off-site watering systems, riparian pasture fencing and grass buffer strips along cropland, help to educate landowners and other community stakeholders. Tours, school workshops and newsletters help the group continue to spread its message.

Christensen encourages other watershed groups to link to the many resources that are available to them, such as PFRA, Alberta Agriculture, Food and Rural Development, Ducks Unlimited, as well as industry leaders within the community. There's strength in numbers, he emphasizes.

"Society is putting pressure, both naïve and informed, on the agriculture industry. And justifiably so, as we do affect water quality. We need to do the right thing," says Christensen. "We need to do what we can to create a proactive image of farming."

LEIGH CHRISTENSEN

It may be many years, even generations, before the water quality within the Crowfoot Creek watershed is greatly improved. But small changes affect the bigger, environmental picture.

"In my opinion, a real success story here will be that we've maintained a certain level of water quality for future generations, but that will take time," says Boehme. "We're trying to work with our neighbours before any regulations come in. There is some long-term commitment here,"

Christensen agrees. "The first rule of order is to forget the finger pointing. We are all facing the same dilemma. Once you do this, you've neutralized the playing field. Then you can roll up your sleeves and get to work."

Part Two

Understanding Watershed Management

This section of the manual identifies the steps a group must take to begin developing a watershed management plan. After reviewing each of the characteristics that make a watershed unique, the next step is to develop a management plan for it. The main challenge for the plan is to have it coordinate the management efforts of all landowners, user groups and stakeholders living and working within the watershed. This way the group can work towards an environmentally and economically healthy watershed.

The Watershed Approach to Watershed Management

The watershed approach helps to define the highest priority problems within a specific geographical area. It also considers the bigger environmental picture, taking into account both ground and surface water flow.

Benefits of a Watershed Approach

Implementing a watershed approach has environmental, financial, social and administrative benefits. As well as its potential for considerable impact on the environment, this type of approach can result in cost savings by building upon the financial resources, knowledge and the willingness of interested people in the watershed to take action. An action plan that focuses on solutions evolves from those knowing the local issues and opportunities. This can help to enhance local and regional economic viability in ways that are environmentally sound and consistent with defined watershed objectives.

The watershed approach also strengthens the teamwork between the public and private sectors at many levels to achieve the greatest environmental improvements with the resources available. Through such active and broad involvement, the watershed approach can build a sense of community, reduce finger pointing and increase commitment to those actions that are necessary to meet societal goals. This will uphold any long-term environmental improvements that are made.

Although watershed approaches may vary in terms of specific objectives, priorities, elements, timing and resources, all should be based on the following guiding principles:

Geographic Focus - Group activities are targeted to a specifically defined geographic area.

Partnerships - Individuals who will be most affected by management decisions are involved throughout the entire planning process. This ensures that environmental, economic, social and cultural objectives are well integrated. They will also inform those who depend upon the natural resources within the watershed and encourage them to participate in planning and implementation activities.

Data Collection - Watershed stakeholders collect scientific data, along with tools and techniques to be used in the decision making process.

The Watershed Management Process

Creating Watershed Partnerships

Although we need to identify the natural resources found within the watershed, it's just as important to gather information on the human population and activities in the area. The watershed group needs to form strategic alliances among its stakeholders, as the plan needs to meet all their needs. Each will have a unique perspective, skill or experience to bring to the group. Creating alliances and forming partnerships among many different groups is the easiest and fairest way to develop and implement an effective stewardship plan. Forming partnerships result in:

- More efficient use of financial resources;
- A spirit of sharing, cooperation and fairness;
- Fewer negative social and economic impacts;
- More creative ways to protect natural resources;
- Increased credibility and knowledge; and,
- Identification of a wider variety of solutions.

One way to find out more about those people living within the watershed is through population demographics. Demographic information offers social and cultural details about the human population as well as its density and distribution. Such specific data helps identify the concerns and priorities of individuals and groups living within that watershed.

Here are some topic areas to explore when finding out more about the people living in the watershed:

- identify owners/operators living within the watershed;
- identify local support or sponsorship;
- discover individuals who are affected within/outside the watershed;
- identify opposing resource interest groups and their agenda;
- explore local political, social and economic issues;
- identify specific opportunities;
- identify human health concerns; and,
- determine landowner consensus.

More information on this topic is available in the publication Building Community Partnerships, A Guide for Creating Effective Land and Water Stewardship. It's a helpful resource for establishing alliances and forming watershed management groups, available through Alberta Agriculture, Food and Rural Development and Agriculture and Agri-Food Canada's Prairie Farm Rehabilitation Administration (PFRA).

Here's an example of the diversity of stakeholders involved with the Crowfoot Creek Watershed Group:

- Wheatland County
- Village of Standard
- Ducks Unlimited
- Health Authority 5
- PanCanadian Energy
- Pheasants Forever
- Town of Strathmore
- Western Irrigation District
- Husky Energy
- Bow River Basin Council
- Elite Swine
- Cargill
- Rosebud River Watershed Partners
- Prairie Farm Rehabilitation Administration
- Alberta Agriculture, Food and Rural Development
- Alberta Environmentally Sustainable Agriculture
- Agriculture & Food Council-CARD Program
- Cows & Fish Program
- Alberta Cattle Commission

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Gathering Watershed Information

Basic site characterization and data collection are the first steps in inventorying a watershed. Characterization may include information on water quality, hydrology, soils, flora and fauna and land use. In addition to detailing the physical and chemical characteristics of the watershed, land ownership and social makeup of the area are important to determine.

One key resource available that helps look at the entire watershed is Geographic Information System (GIS). Landuse maps are an example of a product from GIS. These maps show the resources found in the watershed and what is happening on the land. They can show areas that are prone to wind, soil or water erosion, and identify forages, grasslands, trees, shrubs wetlands and other water bodies.

Geographic Information System:

(ie: cropland, forest, forages, water)

GIS is a tool that can be used to take spatial data, analyze the data and graphically illustrate the analysis to help in developing solutions to issues. GIS is not an automated decision making system, but a tool to query, analyze and map in support of the decision making process.

IMAGES: CRAIG WRIGHT

Such maps can provide the information needed to help establish environmental benchmarks. These benchmarks are important, as they monitor the success of the practices used. They are useful tools when identifying local issues, so that relevant group activities can be selected to address those issues. They can also be used in the decision making process for setting realistic goals for the watershed.

For stakeholders to work together, their actions must be based upon shared information and a common understanding of the roles, priorities and responsibilities of each party involved. Identifying areas of concern within the watershed can help to develop convincing arguments that action is necessary.

Baseline Information

Not all watersheds are created equal. Some are large and defined by perennial rivers, whereas others are small, defined by intermittent creeks. Knowing this, expectations for the watershed need to be realistic and achievable. Little can be accomplished until good baseline information on a watershed's current condition is outlined.

Benchmark Sites

These are areas that provide a base of information, at a particular point in time, that other sites within the same watershed system can be compared to. Benchmarks are the first step in monitoring the plant community, biodiversity and health of the watershed. By knowing what can be achieved in the watershed, realistic goals can be made.

Land Use History

Knowing how the land has been used in the past can provide a history on the physical characteristics of both the watershed and the activity of the people who live in it. There have always been competing land uses, from cattle grazing to oilfield activity. Each of these industries can adversely affect the functioning of the watershed. Knowing land use history can help determine potential impacts. What is important is for the watershed group to understand the dynamics of how humans and the physical watershed have historically interacted.

Tracking land use is part of setting measurable objectives and developing strategies to address specific certain issues. Land use can provide context to observed trends in water quality (for example, nitrates have doubled in the past five years, but so have the number of cropped acres...there may be a connection). Changes in land use may be one tool when the group asks the question: "Have we made a difference?".

Setting Watershed Goals

The next step for the watershed group is to define reasonable goals for managing the watershed.

Having the group participate in the strategic planning process with a neutral facilitator is often helpful in defining those areas the group wishes to explore. A clearly defined vision or mission statement will assist the group in directing their efforts in managing the watershed. For example, the group may determine where water quality concerns originate – from the agriculture industry, land developers, oil and gas activity, or the logging/forestry sector.

CCWG's Mission Statement:

To work with producers and residents towards the adoption of practices so that water leaving the watershed will be equal to or better than when it arrives.

Once your group has decided on the plans necessary to monitor the watershed, it's important to remember that results take time. Many groups want to see immediate results. However, while enthusiasm is great and necessary, one of the most important things the group can do is to focus on one issue or area for improvement within the watershed.

Here are the Crowfoot Creek Watershed Group's goals:

* To increase the adoption of beneficial management practices to help preserve water quality;
* To increase the awareness of local water quality trends;
* To involve the community in planning and implementing activities; and,
* To improve the publics view of agriculture as environmentally sustainable.

When gathering the information needed to monitor the watershed, be sure to consider the following:

- The information's usefulness and contribution to making decisions;
- Its value in demonstrating change;
- Its value in showing lessons learned;
- That it captures things that have helped or hindered along the way; and,
- The group's capacity to collect and interpret it.

Taking Action: Implementing the Plan

After defining the goals your watershed group wants to achieve, it's important begin selecting those watershed activities that will help you to implement that plan.

Remember to:

- Involve the stakeholders who live, work, play in the watershed to participate in the decision-making process.
- Use sound technical info when collecting data.
- Set clear, measurable objectives.
- Select effective management goals.
- Develop innovative strategies that may include education and assistance programs.
- Use neutral, local leadership.
- Partner with local agencies, or government specialists who offer expertise and resources.
- Use a holistic approach that addresses all concerns/challenges.
- Identify effective ways to measure success or failure of each goal.

This chart offers different activities a watershed group could choose from when implementing their watershed goals. For example, the primary goal of stage one activities is to create awareness. Tools such as newsletters, surveys, articles and letters are all geared toward creating awareness among stakeholders living within the watershed. The second stage uses educational tools such as workshops, demonstrations and tours. Activities selected in the final stage help to measure if adoption and changes in practices are occurring within the watershed.

ACTIVITY	AWARENESS LEVEL	RESOURCES	BACKGROUND NEEDED	EVALUATION	RESULTS
Newsletter	Medium	Writer, publisher	An assortment of information including technical, anecdotal	Feedback on articles, Request for more info	Increased knowledge of science and awareness o issues
Surveys	Medium	Writer, analyst	Issues to be raised	Survey's returned, increased interest	Increased awareness
Newspaper articles	Low	Local paper support	An assortment of information including technical, anecdotal	Feedback on articles, Request for more info	Increased knowledge of science and awareness o issues
Letters	Medium	Distribution	Issues to be raised	Survey's returned, increased interest	Increased awareness
Workshops	High	Facilitator, specialists, curriculum	Acceptance of issues	Participation, interest in future activities, practice change	More workshops, follow requested, practice chan happening
Demos	Medium	Proactive producer	Technology that works for local areas	Successive practice demonstration	Practice change
Tours	High	Proactive producers	Working technology in area of tour	Participation, interest during event	Practice change, increase awareness, knowledge o science
One-on-one	High	Trained specialists, coordinator	Acceptance of issues	Participation, interest in future activities, practice change	Practice change

CCWG chose the following activities to help them implement their watershed goals:

* Personalized surveys with landowners
* Demonstration sites that featured off-site watering systems, riparian pasture fencing and grass buffer strips along cropland.
* Tours and school workshops
* Newsletters

Measuring Progress: Monitoring Options

Once the group implements the watershed management plan, it's important to measure if any progress is being made. There are several monitoring options that can help.

To start, individuals working in the watershed planning group can become more actively involved in managing and maintaining the watershed by making visual observations of habitat, land uses and the impacts of storms. This can be done by measuring the water's physical and chemical characteristics and by assessing the abundance and diversity of living creatures such as aquatic insects, plants, fish, birds and other wildlife.

This section looks at different ways to monitor the watershed.

Water Quality Monitoring

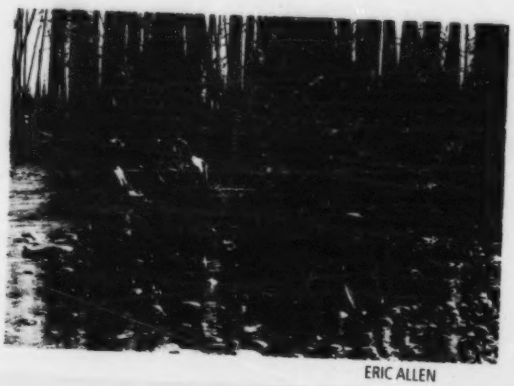
Water quality monitoring is the high level of monitoring done to detect trends in water quality changes over time. Some groups may choose a less costly route of water sampling, which would provide them with information to be used for awareness purposes with their group. Unfortunately this simpler water sampling can't be used as scientific information to study trends.

There are two reasons for monitoring water quality within the watershed. One reason is to confirm that there are concerns with the water quality. This confirmation usually is taken from a specific point in time. The second reason is for the group to identify if the changes being made within the watershed are improving the water quality. To help get this information, water quality can be monitored over a period of years, in order to measure any long-term trends.

Be clear on your reasons for developing a water quality monitoring program for the watershed. Water sampling, which is one method, is very costly. Ask the group these questions:

- Is there historical sites or data available for comparison?
- Is the sampling being done to set up a long-term monitoring program?
- Are you checking the water chemistry at one point or over a broad area?
- Will there be a baseline established for a small water body or a large system?
- Will you be able to locate activities that might be causing changes in water quality?
- How will you evaluate any progress in water quality resulting from changes in practices?
- How will you communicate these changes to the community for feedback?

Any water quality monitoring program needs to be designed in consultation with a professional. Working in consultation with the proper agencies or professionals can provide quality data on such parameters as dissolved oxygen, PH, conductivity, temperature, turbidity, pesticides or even dissolved nutrients. Monitoring can be done with simple instruments or kits that measure pH levels, temperature and conductivity. Sending water samples for laboratory results also provides qualitative data about the chemistry of the water body.



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Here are some advantages and limitations to using water quality monitoring:

Advantages:

- Gives accurate numbers.
- Confirms (scientifically) water quality is a concern.

Limitations:

- Measures only a specific time frame.
- Monitors for awareness and trends.
- Setup requires consultation with specialists.
- For accuracy, monitoring needs to be long-term, which is very expensive.
- May not identify where problem originates.

Publicizing the watershed group's efforts to the media is a great way to tell your story and increase awareness of the goals you're trying to achieve.

Riparian Health Assessments

Monitoring riparian areas within the watershed can provide good information to producers and communities on how they're affecting the watershed. This helps identify the changes needed to enhance the long-term sustainability of stakeholder operations, rural communities and landscapes. Such assessments can provide a foundation so that in about five years, the question of "Did we make it?" can start to be answered.

Riparian health assessments can help:

- Create community awareness about riparian management issues in their local watersheds.
- Help producers and communities take action by assisting local decision-makers develop strategies to find local solutions to address riparian land use issues.
- Build a common understanding between landowners and professionals allowing practical solutions to solve real problems.
- Allows communities and producers to monitor their progress.

Here are the advantages and limitations of using riparian health assessments as a monitoring option:

Advantages:

- Strong process and program exists with Cows and Fish initiative.
- Identifies specific areas of concern for individuals.
- Group learns about health of the creek.
- Baseline can be redone at five-year intervals to evaluate progress.
- Provides visual feedback on management practices.

Limitations:

- Focuses only on land management adjacent to water body.
- Can be costly.
- Doesn't identify water quality.
- Doesn't identify upland effects on water quality.

Conducting Surveys

Another monitoring method is to conduct surveys with surrounding landowners and residents living within the watershed. Surveys can provide critical information about existing practices occurring within the watershed. For example, consultative surveys help to raise awareness, provide education on best management practices, create rich communication linkages and help to acquire feedback and direction on practices, opportunities and limitations.

There are two different approaches to use when collecting survey information. There are either qualitative or quantitative survey techniques. One method of conducting qualitative research is conducting focus group studies. Focus groups are focused discussions led by a moderator and usually involve six to 12 participants. The moderator uses open-ended questions to capture qualitative data on knowledge, opinions and behaviour of participants regarding that topic.

Another method is through respondent driven interviews. In these interviews, the interviewee is given a topic that is of interest to the researcher. The idea in this type of research is to let the interviewee explore the issue, problem or question in any direction they choose.

Questionnaires, telephone interviews, face-to-face interviews and self-administered questionnaires (mail-in surveys) are all examples of ways to gather quantitative data. For quantitative data to be useful and therefore representative of the sample group, a sufficient number of random observations must be made. For instance, 500 individuals might be randomly selected from a population base of 5000, and asked five or 10 questions.

No matter how the data is gathered, surveys provide critical information about the watershed and how the stakeholders within that area perceive certain issues and problems at a given point in time.

Here are just some advantages and limitations to using survey techniques when gathering information about the watershed:

Advantages:

- Helps to understand farming systems in watershed.
- Can identify all activities, players in the watershed.
- Meet residents, producers and provides point of contact with more landowners and players in the watershed.
- Develop relationships with community.
- Community buy-in increases.
- Identifies issues and opportunities.
- Valuable education, ownership tool.

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Limitations:

- Provides only limited information if you don't ask the right questions.
- Time consuming.
- Selection must be random or could cause finger-pointing.
- Must be confidential.
- Data collected must be summarized and reported back.
- May have poor response rate, depending on type of survey used (ie mailback surveys).

Monitoring Change

In addition to identifying the attitudes and knowledge within a watershed at a specific time, surveys can be repeated to measure changes over time. It's important to determine if the stakeholders in the watershed are adopting certain management practices and if changes are occurring within the watershed. Personalized surveys often get high response rates, and as a result, provide the most accurate information.

Personalized, one-on-one survey consultations can:

- raise awareness with landowner about the group and their goals;
- provide information to the group about what land use practices are occurring in the watershed (such as fencing off cattle, using filter strips, using remote watering for cattle, or moving wintering areas);
- help the group identify areas that the watershed needs to focus on for education;
- help develop a rapport and understanding with the landowners; and,
- provide information for further benchmarking questions and evaluation.

Here are some advantages and limitations when monitoring change within the watershed:

Advantages:

- Establishes beginning benchmarks.
- Allows for targeting on awareness level and education needs.
- Helps discover biggest areas of concern.
- May identify people or groups that are not included in working group.
- May get volunteers who are interested in making change.
- Provides contact point with community.

Limitations:

- Difficult to do without some expertise.
- Time consuming.
- Might raise questions the group can't answer.

Evaluating the Progress

It's essential for any group to track the results of their efforts. If the watershed group has designed a plan that is feasible, practical and affordable for all stakeholders involved, then that plan needs to be evaluated. Ask if the group's objectives have been met, then what changes occurred from the plan's actions and activities? Gathering evidence that results were achieved will help convince others that the plan is successful.

Peer pressure and group support are important markers of change within the watershed. Peer pressure is not necessarily negative. Stakeholders in the watershed may see their neighbours' positive results, spurring them to make greater progress or changes.

Perhaps the most convincing information about change within the watershed, is the data collected and documented by the group. Here are some examples of positive changes that can happen to a watershed group:

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- People are changing their management practices;
- The problem is being solved;
- The landscape is changing for the better;
- The issues people are talking about have changed;
- There is more interest in what the group is doing;
- More people have joined the group and are participating in the the group's activities;
- The group is getting broader support from different sources in the community; and,
- As a group, we know more and can we do more for ourselves because we've done this project.

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Summary

Getting the Desired Results

Planning for watershed improvement in your area takes both time and effort on many different levels. All those involved must understand that both the process and progress may seem slow.

Change takes time. It's critical to be committed to the project and to achieving long-term affects that are beneficial for the entire watershed.

Once the group has decided on working together to improve the watershed, it becomes imperative to evaluate the success of its activities. Setting realistic goals will help achieve desired results. During the information gathering process, ask if what you are intending to accomplish as a group is feasible, practical, affordable and within a set budget. Setting realistic, well thought-out goals will help you better plan and organize your group activities. Some of these activities might include:

- What do we want to achieve (objectives);
- Activities to be done for each objective;
- Resources needed for each activity;
- Who will do what;
- When will we do each activity (both start and finish);
- Activity cost and funding source;
- Tracking progress (records collected and targets reached; and,
- Comments, both positive and negative.

Summary

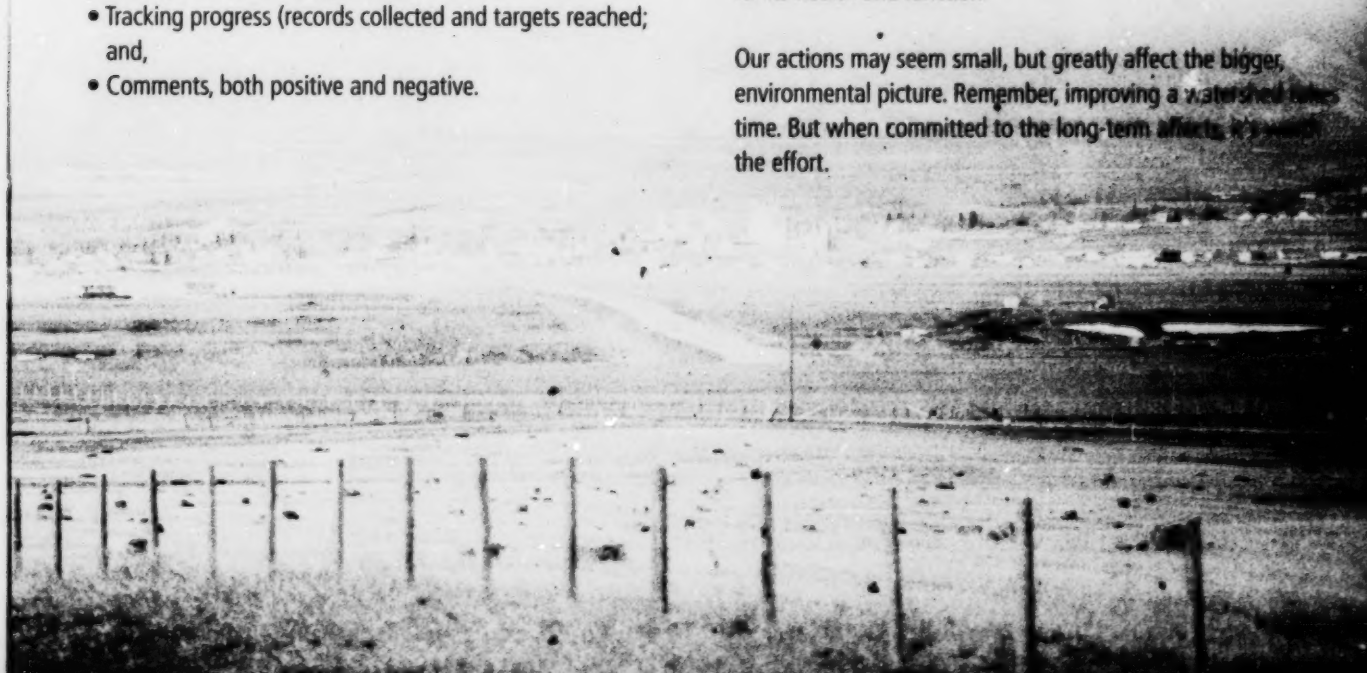
There is a universal need for water. The common thread in improving a watershed is maintaining the quality of life in all its communities, for now and for future generations.

Working to manage a watershed can help to foster community relationships by involving people to care for the watershed together. Be sure to identify those who will be affected by the project, but determine who will have power and influence within the community.

You may want to invite the general public to express their concerns/opinions. You can inform the public through open houses, public forums, posting or mailing background information. Either way, consulting with the community and keeping them informed during your watershed project builds trust, support and understanding from all affected.

The numerous parts of a watershed work together to safeguard other natural systems and habitat that support many aspects of life, for now and the future. And like that puzzle with many pieces, each piece affects the function of the entire watershed. Those of us living and working within the watershed share responsibility for its health and function.

Our actions may seem small, but greatly affect the bigger, environmental picture. Remember, improving a watershed takes time. But when committed to the long-term affects, it's worth the effort.



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For more information on GIS data, please contact your local PFRA office.

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